my way, and could wipe out the traditions of the past, I should vary that entrance examination. I should hold on to the old tradition of the university that it was ready to receive everybody who was likely to profit by its instructions. I should make the examination look, not backward as it does now, but forward, and should only insist that the lad must give such proofs of intelligence and industry as to lead to the hope that the years of university life would not be spent in vain. When the lad has really entered the university (at times he does not do so until he has spent two or even three years at the place in preparation, and sometimes goes away from the place without having really been admitted), it seems to me there should be a still wider scope for his studies. He has even now, it is true, an opportunity to take a degree in one or other of several branches of learning, but in each case he must follow out a particular schedule which has been laid down, and which compels him to walk along a particular path and no other. If he wishes, for example, to study mathematics with philosophy, he would find that he could not do so, for in the examinations mathematicians have nothing to do with philosophy, and philosophy nothing to do with mathematics; and so in other things. I venture to think that this is not a satisfactory condition of things, and that throughout the whole academic course there should be a freedom of the young mind to develop in the line in which it was intended to develop. When I urge this upon my friends, they all say "It is very good, but it is impossible; the examination machinery would become so complicated as to break down." But I would ask the question, Are examinations all in all? Were the examinations made for universities, or were universities made for examinations? I myself have no doubt about the answer. I trust that this new university, which can walk with freedom along new lines, will find some way of so arranging studies and examinations that the two will not conflict, and that anybody coming here will find that the particular gifts that have been given to him, and which it was intended should be developed, will meet their fullest expansion.

Lastly, there was another feature which the old university possessed and which I may also call an essential feature of a university, that is, the spirit of inquiry. No university can prosper as a university that not only does its best to favour special inquiries when these are started within it, but also in the whole course of its teaching develops, or strives to develop the spirit of inquiry. Now here again I fear that examinations—such at all events is my experience—are antagonistic to inquiry; and I would suggest that in arranging examinations one ought always to look ahead to see how far one can possibly order those examinations so as to favour the teaching which teaches in the real and true way, teaching by regarding each bit of learning as in itself an act of inquiry, and so as to favour in the highest degree actual inquiry when it is taken in hand. This of course is antagonistic to one function of examinations, namely, that of putting young men to compete against each other. You cannot so judge inquiries as to put the inquirers in any class list or in any order; the most you can do is to give an inquiry the stamp of approval of the university, a testimony that the inquiry has been carried out in a satisfactory way. It is true that in this way you lose that which is sometimes thought to be of great value, emulation between the scholars; but if you take away that kind of emulation you substitute for it another one far more strong and effective, that emulation that comes of striving with nature. I take it that the good which is done to a lad in starting him upon an inquiry is infinitely greater than any which can be gained by competition with his fellow students. Here I am glad to say a good word for my own university; for we have in a very quiet way, and unobserved, secured the adoption of an enactment which allows a lad to enter the university and obtain his degree and all which follows upon that without entering into a single examination. At the present moment it is possible for one, it is true under exceptional circumstances, to come to the University of Cambridge in England, and if he convinces a competent body of judges that he is a person likely to carry on inquiry in a successful manner he can enter the university as a student, and if he satisfies another body of men after a time that his inquiries have resulted in a real contribution to knowledge he can secure his degree. He can get that without ever having touched a written examination paper, and I am proud that we are able to offer that to the world; for it has happened again and again that a man who had real genius for a particular line of inquiry stumbled over the preliminary studies of which I have spoken, knocked at the door of our university in vain and was sent away. Now such an one would be admitted, and I venture to say that in the long run the university will be the gainer.

These, then, are some few thoughts concerning universities and their methods. I say I have purposely learned nothing about your enactments, but from what I know of your short past I feel confident that this university will in the future be conspicuous for progress. May I hope that it will carry on education along some of the lines which I have indicated to-day, and perhaps some day we in the old country may mend our ways after your pattern.

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## *UNIVERSITY AND EDUCATIONAL INTELLIGENCE.*

The Calendar of the Glasgow and West of Scotland Technical College for the Session 1898–99 has just been issued.

Dr. R. A. Harper, of Lake Forest University, has been appointed to succeed Prof. C. R. Barnes in the chair of Botany in the University of Wisconsin.

Mr. H. R. M. Borland has been appointed junior assistant in the chemical and metallurgical department of the Bristol Merchant Venturers' Technical College.

Mr. Herbert Bolton, who for the last eight years has held the post of assistant keeper in the Manchester Museum, has just been appointed to the curatorship of the Bristol Museum.

We learn from the *American Naturalist* that Miss Phœbe Hearst has given a building for the School of Mines to the University of California. The building will be fully equipped at her expense.

Pfeiffer scholarships in science have been awarded, in connection with the Bedford College for Women, London, to Winifred E. Watts and Margaret Foster. The Reid fellowship, tenable at Bedford College, has been awarded to Margaret Lyal Dale.

Dr. Charles Hunter Stewart, who for the past ten years has acted as chief assistant in the Bacteriological Laboratory connected with the chair of Medical Jurisprudence and Public Health in Edinburgh University, has been appointed to the new professorship of Public Health and Sanitary Science at Edinburgh University.

The Science and Art Directory (revised to June 1898) has just reached us from the Department of Science and Art. In it is to be found, as usual, full information as to the regulations for establishing and conducting science and art schools and classes. Several minor alterations have been made in the regulations, and attention is called to these by the use of italic type.

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## *SCIENTIFIC SERIALS.*

*Memoirs of the Novorossian (Odessa) Society of Naturalists*, vol. xx.—On the origin of *limans* in the Government of Kherson, by M. Rudski. A "liman" is the local name for small bays on the sea-coast which are now separated from the sea by a bar, and offer very interesting peculiarities of structure and fauna. Various hypotheses having been made as to their modes of formation; these hypotheses are discussed, and new observations on the oscillations of the limans are given.—Notes on an excursion to Crimea, by the same. Chiefly on the geological changes going on in the coast-line.—Note on the meteorite of Savchinskoye, by R. Prendel (with a photograph of it).—Geological description of the Odessa district, by Prof. Sintsoff. A great deal of attention is paid to the hydrology of the region, and especially to the *limans* (with a geological map).—The Protozoa of the Haji-bei and Kuyalnik *limans*. No less than 130 species were found in the former, which contains a greater number of marine forms, and 75 in the latter.—Chemical researches in the Marmora Sea, on board the *Selanik*, by A. Lebedintseff. Preliminary report, from which it appears that the existence of bacteria producing sulphuretted hydrogen in the water and the mud of the Marmora Sea cannot be doubted.—On a globular syenite on the Bazavluk, by M. Sidorenko.—On the salinity of the Haji-bei and Kuyalnik *limans*, by Prof. Werigo.—Physical and chemical exploration of the Odessa *limans*, by A.

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Lebedintseff and W. Krzyzanowski.—Geological explorations along railway lines in South Russia, by V. Laskareff.—On the sexual reproduction of *Schizoneura lanigera*, by S. Mokrzecki (with a coloured plate).—On the influence of substitution on the rate of certain reactions, by P. Petrenko Krichenko.—*Crangon vulgaris*, var. *Shidlovskii*, from the Sea of Japan, by Dr. A. Ostroumoff.

Vol. xxi. part I.—Materials for the fauna of Coleoptera of South Russia, by E. Kubkovski. An elaborate work which contains a review of the corresponding literature, a sketch of the distribution of Coleoptera in the Steppes, the sandy regions, the waters, &c., and a detailed enumeration of the species.

*Memoirs of the Novorossian* (*Odessa*) *Society of Naturalists, Mathematical Section*, vol. xvii.—Solar radiation, by M. Pantchenko. The author submits to a careful mathematical investigation the different formulæ proposed by Violle, Langley, Abney, Bartolli, Crova, Angot, and Angström. For purely meteorological purposes he finds Angström's formula sufficient; it gives very good results with the actinometric measurements made in Odessa in 1890, 1891 and 1894.

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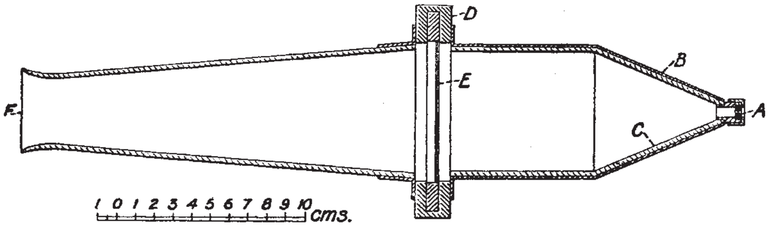
## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society**, June 16.—"On the Source of the Röntgen Rays in Focus Tubes." By Alan A. Campbell Swinton. Communicated by Lord Kelvin, F.R.S. Received June 7.

The author has already described at the Royal Institution (see NATURE for May 26, page 91) how he has found it possible to study by means of pin-hole photography the active area on the anti-kathode of a focus tube from which the Röntgen rays proceed.

By means of a special camera he has now been able to make further investigations. In the illustration A is the pin-hole in a lead disc secured by a cap to the brass cone B, which is lined with thick lead. D is a framework into which slides either the fluorescent screen E, or a carrier containing a sensitive plate should photographs be required. F is an observation tube for use with the fluorescent screen. It is made of insulating material to avoid danger of shocks.



With this apparatus directed at the anti-kathode of a focus tube, it is easy with the fluorescent screen in place to take accurate note of the image of the active anti-kathode area which appears on the screen, and to observe the variations in form, dimensions, and brilliancy that take place under varying conditions. Similarly by replacing the fluorescent screen by a photographic plate the image can be photographed.

The following are the main effects that the author has observed.

(1) When the anti-kathode intersects the kathode stream at the focus, the dimensions of the active area are independent of the degree of exhaustion. For all other positions beyond the focus it is larger the lower the exhaustion and *vice versa*.

(2) When the anti-kathode intersects the kathode stream beyond the focus, the active area is larger the greater the distance between kathode and anti-kathode.

(3) When the anti-kathode intersects the kathode stream considerably beyond the focus, the active area is found to consist of a well-defined and very intense central nucleus, surrounded by a much fainter but quite appreciable halo. Both of these increase in size as the distance between kathode and anti-kathode is increased. In some cases the halo consists of a well-marked hollow ring with a dark space between it and the central nucleus. In other cases two distinct concentric rings are visible surrounding the nucleus.

(4) With an anti-kathode inclined at an angle of 45° to the axis of the conical kathode stream, it is found that those portions of the stream which impinge most normally upon the anti-kathode surface are considerably the most efficient in producing Röntgen rays.

(5) At the degrees of exhaustion most suitable for producing Röntgen rays, and with concave kathodes of the usual dimensions, the kathode stream proceeds almost entirely from a small central portion of the kathode surface, the remaining portion of the surface being apparently practically inoperative. That this is so was very conclusively established by photographs taken with a tube in which three very minute fragments of glass had attached themselves on to the concave surface of the aluminium kathode. The shadows of two of these fragments appeared in the photographs, and enabled accurate measurements to be made.

(6) The different portions of the kathode stream proceeding from different portions of the kathode cross at the focus and diverge in a cone that retains any special characteristics of the convergent cone. The relative positions of the glass fragments on the kathode, and the positions and enlargement of their shadows on the anti-kathode were found to show this very clearly.

(7) Though by far the greater portion of the Röntgen rays given by a focus tube proceed from the active anti-kathode area, still a very appreciable quantity is also given off by all those portions of the glass of the tube that shows the green fluorescence.

Further, it is noticeable that that portion of the glass that shows the brightest fluorescence, *i.e.* that part which lies in the path in which kathode rays would be reflected from the anti-kathode surface were they reflected according to the law of equal angles of incidence and reflection—gives off the most Röntgen rays, while those portions of the glass that show no fluorescence do not give off any Röntgen rays. The conclusion appears obvious that whatever produces the one also produces the other, but as has been pointed out by Prof. S. P. Thompson the fluorescence is not due to the direct stream of rays from the kathode, but to some description of radiation that proceeds from the surface of the anti-kathode that faces the kathode.

Prof. Thompson calls these radiations "para-kathodic rays," stating that they differ from the Röntgen rays in respect of their power of penetration, and in their capacity of being electrostatically and magnetically deflectable. In these respects the author's experiments confirm those of Prof. Thompson; but when the latter goes on to differentiate these rays from ordinary kathode rays, on account of their not exciting Röntgen rays where they impinge on a solid surface, the author is unable to agree, for, as above stated, these rays do excite Röntgen rays where they impinge upon the glass walls of the tube.

The "para-kathodic" radiations do not, however, appear to be ordinary kathode rays. In the first place they do not proceed directly from the kathode, but only from the surface of the anti-kathode that faces the latter. Secondly, they do not appear to be negatively but positively charged. The author suggests that they may very probably consist of kathode ray particles which, having struck the anti-kathode, and having thus given up their negative charges and acquired positive charges, rebound, both by reason of their elasticity and also by repulsion from the anti-kathode. Perhaps, owing to the comparative roughness of the anti-kathode surface, they fly off to some extent in all available directions, but they do so especially in that direction which the law of equal angles of incidence and reflection requires. It also appears very possible that these rays are identical with the positively electrified streams proceeding from the anode, which the author has investigated by means of radiometer mill wheels, recently described in his paper to the Physical Society (see NATURE for March 31 and June 2, pp. 525 and 119.

"Mathematical Contributions to the Theory of Evolution. V. On the Reconstruction of the Stature of Prehistoric Races." By Karl Pearson, F.R.S., University College, London. Received June 6.

The object of this memoir is to illustrate the general theory by which we may reconstruct from the knowledge of one organ in a fossil or prehistoric race, the dimensions of other organs, when the correlation between organs in existing races of the

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